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TITLE: GOLF PUTT-LINE VARIANCE DETERMINING SYSTEM

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DOC NO.: G724

BACKGROUND OF THE INVENTION

The invention relates to a golf putt-line variance  
determining system. More particularly, the invention relates  
to a system that measures the topography along a golf putt-  
line between a point of origin and the hole to provide an  
offset distance at which the golfer should aim his/her golf  
stroke.

Golf begins with the "long game", which involves driving  
the ball toward the hole over a significant distance using an  
aggressive stroke. The object of the long game is to get the  
golf ball as close to the hole as possible, to minimize the  
distance between the ball and hole during "putting".

Putting involves gentler, controlled strokes that seek to gently move the ball toward the hole – or at least close the distance between the ball and hole. Considerable precision is required during putting. Analogous to driving, where the golf ball is subject to the influence by air currents, during putting the golf ball is subject to influence by the terrain of the putting green. In particular, the slope of the terrain has a significant effect on the trajectory of the ball. Even when the ball is aimed precisely at the hole, a sloped terrain will cause the ball to deviate significantly from its intended target. Accordingly, when the putting green is sloped, even a relatively short putt can miss the mark.

United States Patent No. 5,330,188 to Reimers discloses a putter alignment system that uses a signal emitter mounted on the putting head, and remote target component placed behind the hole to help train a golfer to aim the putter on a straight line, centered with the hole. As discussed above, aiming for the center of the hole has little value on a sloped putting green. Accordingly, Reimers has little value in training a golfer how to alter the trajectory of the putt to compensate for the sloped green.

Similar to Reimers, Chen discloses a golf training device that emits a light beam from a central point on the putter head, and indicates to the golfer when the beam is in

alignment with the target. Also similar to Reimers, United States Patent No. 5,692,966 to Wash discloses a golf putting training device that helps train a golfer to aim the putter head perpendicular to the putt line, by indicating when the  
5 putter head is parallel to the electronic training device. Accordingly, Wash and Chen have little value for training a golfer to compensate for slope during putting.

United States Patent No. 5,818,036 to Daly discloses a  
10 laser aided practice putting device and method. In particular, Daly discloses a device which emitters a visible beam of laser light from a target to act as a fixed guide to help the golfer find a straight line to the target.

15 United States Patent No. 6,129,641 to Burch discloses a golf putting scope, which functions as a periscope, such that the golfer can look downward into the scope to see if and how the ground slopes between the ball position and the flag. Burch, however, does not measure the slope along the putt  
20 line, nor does it provide any guidance as to how the golfer must alter the putt to successfully reach the hole.

Further examples of devices that attempt to improve a golfer's putting stroke are provided by United States Patent  
25 No. 6,458,038 to Lin and United States Patent No. 6,461,247 to Riddell. Lin discloses a golf putting indication device that uses a plurality of honeycombed sensors to measure the

arch of a putter swing. Riddell discloses a device that employs a pair of spaced members, and a pair of cords extending between the members, and allows a golfer to realize the linearity of the putting stroke.

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While these units may be suitable for the particular purpose employed, or for general use, they would not be as suitable for the purposes of the present invention as disclosed hereafter.

## SUMMARY OF THE INVENTION

It is an object of the invention to produce a golf putting aid that helps a golfer successfully achieve a putt on a sloped putting green. Accordingly, the present invention provides a variance determining system that indicates to a golfer the distance to vary the putt in view of the terrain.

It is another object of the invention to provide a golf putting aid that assesses the slope of the putting green and provides the golfer with a numeric output which instructs the golfer to aim off-center from the hole by that numeric output.

It is a further object of the invention to provide a golf putting aid that is suitable for use on a putting green where the slope changes along the putt line. Accordingly, the variance determining system samples the slope at various points along the putt line in order to make an accurate offset-distance recommendation.

It is a still further object of the invention to provide a golf putting aid that provides a way for the golfer to use the offset-distance recommendation and adjust the putt-line appropriately. Accordingly, a target is provided which sits behind the hole and allows the device to measure

the distance to the hole at each of the slope measurements, and then provides a calibrated surface that allows the golfer to appropriately adjust the putt angle by the offset-distance recommendation.

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The invention is an offset measurement system, for aiding a golfer when putting upon a putting green having varying slope between a golf ball, resting upon the green, and a hole having a hole center. A target having a target  
10 line is positioned at the hole with the target line aligned with a direct putt line that connects the hole center and ball. A measurement device is used to acquire multiple measurement data sets having the slope of the putting green at a position along the direct putt line and a distance to  
15 the target at that position. The measurement device calculates and displays a recommended offset distance from the measurement data sets that is used by the golfer to redirect the putt at the hole by the recommended offset distance from the direct putt line.

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To the accomplishment of the above and related objects the invention may be embodied in the form illustrated in the accompanying drawings. Attention is called to the fact, however, that the drawings are illustrative only. Variations  
25 are contemplated as being part of the invention, limited only by the scope of the claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, like elements are depicted by like reference numerals. The drawings are briefly described as follows.

FIG 1 is a diagrammatic perspective view illustrating the present invention, wherein a measuring target is positioned behind a putting green hole, and a measuring device is positioned over a golf ball, with a direct putt line illustrated in phantom extending between the golf ball and the hole

FIG 2 is a diagrammatic perspective view, illustrating the measuring device positioned at multiple positions along the direct putt line, whereas measurements are taken at each of these multiple positions.

FIG 3 is a block diagram, illustrating the major functional components of an embodiment of the measuring device.

FIG 4 is a flow diagram, illustrating steps in determining a recommended offset distance.

FIG 5 is a diagrammatic perspective view, illustrating a further embodiment of the invention.

FIG 6 is a diagrammatic perspective view, illustrating the measuring target being used to guide the golfer to redirect the putt line according to the recommended offset distance.



## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG 1 illustrates an offset determining system 10, for use by a golfer, when putting upon a putting green 12, having a hole 14. The hole 14 has a hole center 14C. A golf ball 16 is positioned a distance from the hole 14. A direct putt line 18 connects the golf ball 16 and the hole center 14C.

The offset determining system 10 includes a measuring device 20 and a measuring target 30. The target 30 is substantially rectangular, having a pair of short sides 31 and a pair of long sides 32. The target has a target face 33 having a target line 34 visible thereon, extending longitudinally such that the target line 34 is substantially parallel to the long sides 32. The target 30 is adapted to stand upright upon the putting green 12, such that the target face 33 is perpendicular to the putting green 12. When the offset determining system 10 is used to ascertain an offset distance, the target line 34 is positioned as illustrated, such that it extends vertically behind the hole 14 such that the target line 34 is aligned with the direct putt line 18. In particular, the golfer initially positions the measuring target 30 by aligning the target line 34 with the golf ball 16, through the hole center 14C. The target face may be reflective to facilitate proper alignment of the target 30, and of the measurement device with the target 30 in the manner described hereinafter. The target 30 may also have a

protrusion 39 extending from one of the short sides that is sized and shaped to fit within the hole 14 for allowing the target 30 to be placed directly over the hole, with said short side 31 extending across the hole 14 and upon the  
5 putting green 12.

The measuring device 20 has a housing 21 having a top 20T, a bottom 20B, side edges 20S, a front 20F and a rear 20R. A positioning arrow 23 is imprinted on the top 20T,  
10 directed toward the front 20F and perpendicular thereto. Selection buttons 22 and a display 24 are located on the rear 20F.

According to the embodiment of the invention  
15 illustrated, an arched tunnel 26 extends fully between the front 20F and rear 20R and is open at the bottom 20B fully therebetween. According to this embodiment, the measuring device 20 is positioned over the golf ball 16 with the golf ball 16 in the arched tunnel 26. In this maximum position  
20 20P, an initial measurement is taken.

The measuring device 20 collects measurement data sets, which comprise a slope angle and a distance to the hole 14 at its current location. Accordingly, the measuring device 20  
25 contains at least one inclinometer and a rangefinder. The rangefinder may be an ultrasonic module that measures the distance from the front 20F of the housing 21 to the target

30, or any other suitable technology capable of measuring the distance from the front 20F of the housing 21 to the target 30. The inclinometer may be oriented longitudinally across the housing 21, substantially parallel to the front 20F, rear 20R, and bottom 20B. In this position, the inclinometer measures a transverse slope – that is, transverse to the direct putt line 18. It should be noted that for the purposes of the present invention, the golf ball may be substituted with a marker – which is especially helpful in embodiments of the invention that do not have the arched tunnel 26.

Accordingly, the measuring device 20 takes an initial measurement at the maximum position 20P illustrated in FIG 1, and acquires a measurement data set thereat, which comprises the maximum distance to the hole 14 and the transverse slope at the measuring device. Of course, the measurement data set taken at the maximum position is useful for determining the potential variance of the ball from a straight-line trajectory. Considering that the slope is rarely consistent along the direct putt line, such data is a very rough approximation of the trajectory.

Referring then to FIG 2, according to the present invention, multiple measurement data sets are acquired at various positions (20', 20'', 20''') further along the direct putt line than the maximum position 20P. Thus, at each of

these positions, the slope is measured and is associated with the distance from the hole thereat. In particular, the measuring device 20 is repositioned along the direct putt line 18, and one of the selection buttons 22 is pressed to  
5 initiate the acquisition of a measurement data set. Once the measurement has been taken, the measuring device 20 may indicate the same to the golfer using audible and or visual means. Multiple iterations of repositioning the measurement device and initiating a measurement, while moving the  
10 measuring device 20 toward the hole 14 along the direct putt line are performed by the golfer. Through the acquisition of numerous measurement data sets – or samples – the topography along the putt line is most closely mathematically modeled.

15 After sufficient measurements have been made, or when a calculation is requested by the golfer using the selection buttons 22, the measurement device calculates a recommended offset distance, visually indicates said recommended offset distance on the display 24, and may audibly indicate the  
20 recommended offset distance through speech synthesis. To facilitate easy reading by the golfer, the display 24 may be angled upward.

The recommended offset distance is a vector of the  
25 distance along an offset line 19 that is adjacent to the hole and transverse to the direct putt line 18. The recommended offset distance tells the golfer 40 how far to the left or

right of the direct putt line to redirect the putt.

Accordingly, referring to FIG 6, the recommended offset distance suggests a redirected putt line 18A to the golfer. The redirected putt line is intended to compensate for the average slope between the maximum position and the hole so that if the golf ball 16 is accurately hit along the redirected putt line 18A, the slope of the putting green will carry the ball toward the hole 14.

10           To help the golfer 40 implement the recommended offset distance to aim the stroke along the redirected putt line 18A, the target 30 is rotated, so that one of the long sides 32 is laid upon the putting green 12 immediately behind the hole 14, centered with respect to the direct putt line 18, with the target line facing the golf ball, and thus the golfer. Accordingly the target face 33 has a series of calibrated lines 37 along at least one of the long sides 32, which indicate various distances from the center of said long side 32. The calibrations preferably indicate distances in both the metric and English measurement systems.

20           Accordingly, the measurement device 20 preferably selectively displays the recommended offset distance in both inches and centimeters.

25           The recommended offset distance is calculated by any algorithm, which may be determined by those of ordinary skill in the art without undue experimentation, which can determine

the recommended offset distance using the mathematical modeling of the topography between the putt line and hole 14 formed by the measurement data sets and the application of general principles of physics and trigonometry.

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An example of the algorithm is as follows: sum the horizontal (transverse) components and vertical (longitudinal) components of vectors created by each measurement data set. Create a resultant vector from the summed horizontal and vertical components. Determine the recommended offset distance by multiplying the sin of the resultant vector angle by the maximum distance, and adjusting that result by a factor or constant to compensate for surface resistance and perhaps for the short distance between the offset line 19 and the center of the hole 14C.

To aid the measurement device in implementing this functionality and communicating with the user/golfer, the selection buttons 22 preferably include a READ button, which prompts a reading and the acquisition of a measurement set; a DATA button, which scrolls through all current measurement sets; a CLEAR button which, clears all previous readings; a MODE button, which selectively chooses display of readings in the metric or English measurement systems; and a P-LINE button, which prompts a calculation of the recommended offset distance. Referring to FIG 3, the measurement device 20 has a control unit 50, which receives input from the selection

buttons 22, and calculates the recommended offset distance and visually indicates the same on the display 24. The control unit also accepts inputs from a transverse inclinometer 54T, and according to a further embodiment of the invention: from a longitudinal inclinometer 54L.

FIG 5 outwardly illustrates the further embodiment of the invention having the longitudinal inclinometer. In particular, the housing 21 has a cross member 27 which extends perpendicularly from the front 20F to the rear 20R. On the cross member 27, the housing 21 has a pair of longitudinal sides 20LS. In particular, the longitudinal sides 20LS of the cross member 27 extends forwardly and rearwardly substantially as far as the distance between the transverse sides 20TS of the housing 21. Accordingly, when placed upon the golfing green, the bottom 20B of the housing 21 will engage the ground surface at the transverse sides 20TS and longitudinal sides 20LS. The housing 21 will enter a position that approximates the slope of the putting green in both the transverse and longitudinal directions. Thus, according to the embodiment shown in FIG 5, a pair of inclinometers are present within the housing 21 — namely the longitudinal inclinometer extending longitudinally parallel to the bottom 20B and the transverse inclinometer extending transversely parallel to the bottom 20B. The measurement device 20 is used just as previously described, where the positioning arrow is aligned with the direct putt line 18.

Multiple measurement sets are acquired – first at the maximum position, and then at subsequent positions along the direct putt line 18. Then, the offset distance is calculated from a three dimensional mathematical modeling of the golfing green to provide a recommended offset distance which more precisely indicates where the golfer should aim the golf stroke.

Accordingly, then, usage of the offset determining system and the procedure followed according to the present invention is illustrated in the flow diagram of FIG 4. In particular, the target is initially positioned behind the hole 100. Then the measuring device is reset 102, such that it is cleared of any measurement sets in memory such that it is ready to take measurements for a new putt, and the measuring device is placed at the maximum position – directly over the golf ball on the putting green. Then, the distance to the target and slope is measured at the device 104. Then, the measuring device is moved toward the hole along the direct putt line 106, and the measurement of the distance to the target and the slope at the device is repeated 108. Then, it is determined whether sufficient measurements have been taken 110. Such determination may be made by the device, but is most probably made by the golfer/user. If insufficient measurements have been taken to precisely model the topography of the putting green, the steps of moving the measuring device toward the hole along the direct putt line 106 and taking repeated measurements of the slope and



distance to the target 108 are carried out until sufficient measurements have been taken. Once sufficient measurements have been taken, the recommended offset distance is calculated by the device 112, and displayed on the device 5 114. With the recommended offset distance in hand, the golfer aims the putt toward the hole, compensating for the recommended offset distance 116.

In conclusion, herein is presented a system for 10 determining a recommended offset distance for a golfer while putting, taking into account the topography of the putting green between the ball and the hole. The invention is illustrated by example in the drawing figures, and throughout the written description. It should be understood that 15 numerous variations are possible, while adhering to the inventive concept. Such variations are contemplated as being a part of the present invention.